

**PROCESS FOR MAKING A BICYCLE FRAME PART, AND BICYCLE
FRAME INCLUDING THE BICYCLE FRAME PART BACKGROUND OF
THE INVENTION**

1. Field of the Invention

[0001] The invention relates to a process for making a bicycle frame part, more particularly to a process for making a bicycle frame part having an appearance free of welding scars. The invention also relates to a bicycle frame including a bicycle frame part produced according to the process.

2. Description of the Related Art

[0002] Referring to Figure 1, a conventional bicycle frame 10 essentially includes a head tube 11, a seat tube 12, a five-way connector 13, a cross bar 14, a down tube 15, a seat stay 16 and a chain stay 17. The conventional bicycle frame 10 is usually constructed by welding the aforementioned bicycle frame parts to each other. However, the conventional bicycle frame 10 has a lot of welding scars formed at the joints of the welded bicycle frame parts, which affect the appearance of the bicycle frame. The welding process also increases the manufacturing cost and limits the flexibility in the design of the bicycle frame.

[0003] Although a bicycle frame made of carbon fiber can be made via an integral-forming process, the manufacturing cost thereof is relatively high.

SUMMARY OF THE INVENTION

[0004] Therefore, an object of the present invention is to provide a process for making a bicycle frame part having an appearance free of welding scars.

[0005] Another object of the invention is to provide a bicycle frame having a bicycle frame part produced according the process.

[0006] The process for making a bicycle frame part according to this invention includes the steps of: placing a one-piece metallic tube blank in a die; hydraulically forming the tube blank by introducing a hydraulic pressure into the tube blank to deform and expand the tube blank so as to form at least one expanded wall part projecting from the tube blank along a direction different from the direction of extension of the tube blank; and machining the expanded wall part to form a connection tube.

[0007] The bicycle frame according to this invention includes a plurality of frame parts connected to each other. At least one of the frame parts is formed via the aforementioned process, and includes a tube body and at least one connection tube projecting from the tube body in a direction different from the direction of extension of the tube body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiments with reference to the accompanying drawings, of which: Figure 1 is a schematic view of a conventional bicycle frame;

[0009] Figure 2 is a schematic view of the preferred embodiment of the bicycle frame according to this invention;

[0010] Figure 2A is a schematic view of a seat stay of the bicycle frame of Figure 2;

[0011] Figure 2B is. a schematic view of a chain stay of the bicycle frame of Figure 2;

[0012] Figure 3 illustrates consecutive steps of the preferred embodiment of the process for making a bicycle frame part according to this invention;

[0013] Figure 4 is a schematic view of another preferred embodiment of the bicycle frame according to this invention;

[0014] Figure 4A is a schematic view of a seat stay of the bicycle frame of Figure 4;

[0015] Figure 4B is a schematic view of a chain stay of the bicycle frame of Figure 4;

[0016] Figure 5, 6, and 7 illustrate consecutive steps of another preferred embodiment of the process for making a head tube, a first connector, and a second connector of a bicycle frame according to this invention, respectively; and

[0017] Figure 8 is a perspective view of a head tube produced by the preferred embodiment of Figure 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] Referring to Figures 2, 2A and 2B, the preferred embodiment of the bicycle frame according to this invention includes a plurality of bicycle frame parts, such as a head tube 241 integrated with a cross bar 22 and a down tube 23 to form a one-piece unitary unit, a seat tube 41, a five-way connector 42, a seat stay 50, and a chain stay 60, which are connected to each other to form the bicycle frame. Some of the bicycle frame parts, such as the one-piece unitary unit, the seat stay 50 and the chain stay 60 can be made by the process for making a bicycle frame part according to this invention.

[0019] Referring to Figure 3, which illustrates the preferred embodiment of the process of the invention for making the one-piece unitary unit, a one-piece metallic tube blank 20, which is preferably made of an aluminum alloy, is bent to form a turn 24 and two tube section 22, 23 at two sides of the turn 24. The tube sections 22, 23 form an acute angle therebetween. The bent tube blank 20 is then placed in a die 30 provided with a die cavity 31 and two die openings 31' communicated with the die cavity 31. When the tube blank 20 is placed in the die cavity 31, two open ends 20' of the tube blank 20 are aligned and communicated respectively with the die openings 31'. The tube blank 20 is then hydraulically formed by introducing a hydraulic pressure from hydraulic cylinders 32 into the tube blank 20 through both of the die openings 31' and through both of the open ends 20' of the tube blank 20 to deform and expand the tube blank 20 at the turn 24 so as to form an expanded wall part 241 projecting from the tube blank 20 along a direction different from the direction of extension of the tube blank 20. The tube sections 22, 23 are formed into the cross bar 22 and the down tube 23. The expanded wall part 241 is then machined by drilling to form two openings at two opposite ends of the expanded wall part 241, which are opposed to one another along a direction transverse to the tube sections 22, 23, thereby forming the expanded wall part 241 into a connection tube that serves as the head tube 241. The one-piece unitary unit further includes an insert tube 243 fitted inside the expanded wall part 241.

[0020] Referring to Figures 4, 4A and 4B, another preferred embodiment of the bicycle frame according to this invention is shown to include the bicycle frame parts, such as a cross bar 81, a down tube 82, a seat

tube 41, a seat stay 50, a chain stay 60, a first connector 90 interconnecting the cross bar 81, the seat tube 41, and the seat stay 50, a second connector 42 fixed to the seat tube 41 opposite to the first connector 90 and interconnecting the down tube 82, the seat tube 41 and the chain stay 60, and a head tube 71 connected to the cross bar 81 and the down tube 82 opposite to the first and second connectors 90, 42. The bicycle frame parts, such as the head tube 71, the first connector 90 and the second connector 42, of this preferred embodiment can be made by another preferred embodiment of the process for making a bicycle frame part according to this invention as shown in Figure 4, 5 and 6.

[0021] Referring to Figure 5, which illustrates the preferred embodiment of the process for making the head tube 71 of the bicycle frame according to this invention, a substantially straight one-piece metallic tube blank 70, which is preferably made of an aluminum alloy, is placed in a die 30 which is provided with a die cavity 31 and two die openings 30' communicated with the die cavity 31. When the tube blank 70 is placed in the die cavity 31, opposite open ends 73, 74 of the tube blank 70 are aligned and communicated respectively with the die openings 30'. The tube blank 70 is hydraulically formed by introducing a hydraulic pressure from hydraulic cylinders 32 into the tube blank 70 through both of the die openings 30' and through both of the open ends 73, 74 of the tube blank 70 to deform and expand the tube blank 70 so as to form two expanded wall parts 75, 76 projecting in two different direction from two axially aligned and spaced apart locations of the tube blank 70. Each of the expanded wall parts 75, 76 is machined to form a connection tube.

[0022] Figures 6 and 7 illustrate the preferred embodiment of the processes for making the first connector 90 and the second connector 42 according to this invention, respectively, which are similar to that shown in Figure 5, except that the projecting direction and/or the number of the expanded wall parts of the first connector 90 and the second connector 42 are different from those of the head tube 71.

[0023] Figure 8 shows the head tube 71 made according to the process shown in Figure 5. The head tube 71 has a pair of the connection parts 75, 76 projecting from the tube body 70 and to be connected respectively to the cross bar 81 and the down tube 82, as shown in Figure 4.

[0024] Referring to Figure 6, the first connector 90 made according to this preferred embodiment includes two connection tubes 91, 93 which can be connected respectively to the cross bar 81 and the seat stay 82, as shown in Figure 4.

[0025] Referring to Figure 7, the second connector 42 made according to this preferred embodiment includes three connection tubes 421, 422, 423 which can be connected respectively to the seat tube 41, the down tube 82, and the chain stay 60, as shown in Figure 4.

[0026] While the present invention has been described in connection with what is considered the most practical and preferred embodiments, it is understood that this invention is not limited to the disclosed embodiments but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.